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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/437,135 11/10/99 YAMAZAKI

S 0756-2064

EXAMINER

MMC2/0320
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KIELIN, E	
ART UNIT	PAPER NUMBER

2813
DATE MAILED:

03/20/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/437,135

Applicant(s)

Yamazaki et al.

Examiner

Erik Kielin

Group Art Unit
2813

☒ Responsive to communication(s) filed on Feb 23, 2001

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-37 is/are pending in the application.

Of the above, claim(s) 15-28 is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-14 and 29-37 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☒ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☒ received in Application No. (Series Code/Serial Number) 08/721,526.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 5-8

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

Art Unit: 2813

DETAILED ACTION

Priority

1. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in parent Application No. 08/721,526, filed on 9/26/96.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-4, 6-9, 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art (APA) in view of either Ang et al. ("Electrical characterization of low-pressure chemical-vapor-deposited silicon dioxide metal-oxide-silicon structures" Journal of Applied Physics 73(5), pp. 2397-2401, 1 March 1993).

Applicant's APA discloses that it is known in the art to make a TFT by forming a semiconductor film comprising amorphous silicon over a substrate; crystallizing said semiconductor film by irradiating a laser light; forming an insulating film on the crystallized semiconductor film by vapor phase deposition (Applicant's specification, pages 2-4).

Art Unit: 2813

Applicant **APA** does not teach annealing the insulating layer in an atmosphere comprising an oxygen gas.

Ang teaches the benefits of depositing an insulating layer for a gate oxide using LPCVD and then thermally annealing in oxygen using a Heatpulse 210T rapid thermal processor which emits high intensity IR light (see attached document, page 1, from UC-Berkeley obtained by the Internet for verification) in order to reduce the interfacial layer density (called both "fixed charge density" and "interface state density" therein) to well below 10^{11} cm^{-2} . (See Abstract and section entitled "Experiment.")

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Applicant's **APA** with **Ang** for the numerous benefits taught by **Ang**.

4. Claims 1-4, 6-9, 11-13, 29, 30-33, and 34-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's **APA** in view of **Roy** (US 5,153,701) and **Wolf** (Silicon Processing for the VLSI Era, Vol. 1, Lattice Press: Sunset Beach, CA, 1986, pp. 57-58) or alternatively in view of **Roy** and **JP 58-098933**.

Applicant's APA is applied as above.

Roy teaches the benefits of using LPCVD or PECVD and TEOS to form an insulating film comprising SiO_2 on a semiconductor film for use as a gate electrode and then annealing in oxygen for the express purpose of reducing interfacial layer density (called "charge traps" or

Art Unit: 2813

“interface trap density” therein). (See column 2, lines 16-21; column 3, lines 23-44; column 7, line 41).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Applicant’s APA in view of Roy for the reasons indicated in Roy or specifically annealing in oxygen to reduce interfacial layer density.

Then the only difference is that high intensity IR annealing is not taught.

Wolf teaches the benefits of rapid thermal annealing using high intensity IR. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the high intensity IR annealing method of **Wolf** for the **Roy** annealing source of heat for the reasons in **Wolf**.

Alternatively, **JP 58-098933** teaches the benefits of using CVD to deposit an insulating film comprising SiO₂ on a silicon substrate, followed by UV, IR or laser annealing to expressly reduce the interfacial layer density (called “boundary level density” therein). (See Abstract and Derwent Abstract.)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use IR as the annealing method for the reasons in **JP 58-098933**, which include specifically to reduce the interfacial state density at the Si/SiO₂ interface of CVD deposited SiO₂.

5. Claims 5 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Applicant’s **APA** in view of **Ang** or alternatively over Applicant’s **APA** in view of **Roy** and **Wolf**

Art Unit: 2813

or alternatively over Applicant's **APA** in view of **Roy** and **JP 58-098933**, any of the above as applied to claims 1-4, 6-9 above, and further in view of **JP 60-187030**.

Applicant's APA does not indicate the kind of laser to be used for crystallizing the silicon film. But **JP 60187030** discloses the benefits of Applicant's claimed laser for such crystallizing (Abstract). It would have been obvious to one of ordinary skill in the art at the time the invention was made to crystallize the silicon using the lasers in **JP 60187030** for the reasons indicated therein.

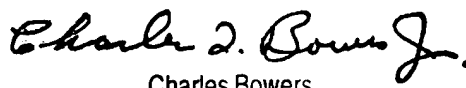
Conclusion

Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached at (703) 308-2417 or by e-mail at charles.bowers@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.


EK

March 15, 2001


Charles Bowers
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